

What is claimed is:

1. A cobalt-nickel-iron alloy thin film containing 60 to 75 weight % cobalt, 10 to 20 weight % nickel, and 10 to 20 weight % iron and having a crystal structure that is a mixture 5 of a body-centered cubic structure phase and a face-centered cubic structure phase, wherein  $I_b/I_f$  is in the range of 0.3 to 0.7 inclusive where  $I_b$  represents the intensity of an X-ray diffracted from a (110)-plane of the body-centered cubic structure and  $I_f$  represents the intensity of an X-ray 10 diffracted from a (111)-plane of the face-centered cubic structure.

2. A method of forming a cobalt-nickel-iron alloy thin film containing 60 to 75 weight % cobalt, 10 to 20 weight % 15 nickel, and 10 to 20 weight % iron, and having a crystal structure that is a mixture of a body-centered cubic structure phase and a face-centered cubic structure phase through electroplating,

wherein the cobalt-nickel-iron alloy thin film is formed 20 such that  $I_b/I_f$  falls within the range of 0.3 to 0.7 inclusive where  $I_b$  represents the intensity of an X-ray diffracted from a (110)-plane of the body-centered cubic structure and  $I_f$  represents the intensity of an X-ray diffracted from a (111)-plane of the face-centered cubic structure.

3. A method of forming a cobalt-nickel-iron alloy thin

film according to claim 2, wherein the pH of a plating bath for forming the cobalt-nickel-iron alloy thin film through electroplating is adjusted to 3.0 to 4.0 inclusive.

5        4. A method of forming a cobalt-nickel-iron alloy thin film according to claim 3, wherein the value of Ib/If is controlled by controlling the pH of the plating bath.

5.A thin-film magnetic head comprising:

10        a medium facing surface that faces toward a recording medium;

      a first magnetic layer and a second magnetic layer magnetically coupled to each other and including magnetic pole portions that are opposed to each other and placed in regions 15 of the magnetic layers on a side of the medium facing surface, each of the magnetic layers including at least one layer;

      a gap layer provided between the magnetic pole portions of the first and second magnetic layers; and

20        a thin-film coil at least a part of which is placed between the first and second magnetic layers, the at least part of the coil being insulated from the first and second magnetic layers, wherein:

      at least either of the first and second magnetic layers includes a part made of a cobalt-nickel-iron alloy thin film;

25        and

      the cobalt-nickel-iron alloy thin film contains 60 to 75

weight % cobalt, 10 to 20 weight % nickel, and 10 to 20 weight % iron, and has a crystal structure that is a mixture of a body-centered cubic structure phase and a face-centered cubic structure phase, in which  $I_b/I_f$  is in the range of 0.3 to 0.7  
5 inclusive where  $I_b$  represents the intensity of an X-ray diffracted from a (110)-plane of the body-centered cubic structure and  $I_f$  represents the intensity of an X-ray diffracted from a (111)-plane of the face-centered cubic structure.

10

6. A method of manufacturing a thin-film magnetic head comprising: a medium facing surface that faces toward a recording medium; a first magnetic layer and a second magnetic layer magnetically coupled to each other and including magnetic  
15 pole portions that are opposed to each other and placed in regions of the magnetic layers on a side of the medium facing surface, each of the magnetic layers including at least one layer; a gap layer provided between the magnetic pole portions of the first and second magnetic layers; and a thin-film coil  
20 at least a part of which is placed between the first and second magnetic layers, the at least part of the coil being insulating from the first and second magnetic layers, wherein at least either of the first and second magnetic layers includes a part made of a cobalt-nickel-iron alloy thin film, the method  
25 including the steps of:

forming the first magnetic layer;

forming the gap layer on the first magnetic layer;

forming the second magnetic layer on the gap layer; and

forming the thin-film coil,

wherein at least either of the steps of forming the first

5 magnetic layer and the second magnetic layer includes the step

of forming the cobalt-nickel-iron alloy thin film through

electroplating, the cobalt-nickel-iron alloy thin film

containing 60 to 75 weight % cobalt, 10 to 20 weight % nickel,

and 10 to 20 weight % iron, and having a crystal structure that

10 is a mixture of a body-centered cubic structure phase and a

face-centered cubic structure phase, in which  $I_b/I_f$  is in the

range of 0.3 to 0.7 inclusive where  $I_b$  represents the intensity

of an X-ray diffracted from a (110)-plane of the cubic-centered

structure and  $I_f$  represents the intensity of an X-ray

15 diffracted from a (111)-plane of the face-centered structure.

7. A method of manufacturing a thin-film magnetic head according to claim 6, wherein the pH of a plating bath for forming the cobalt-nickel-iron alloy thin film through electroplating is adjusted to 3.0 to 4.0 inclusive.

8. A method of manufacturing a thin-film magnetic head according to claim 7, wherein the value of  $I_b/I_f$  is controlled by controlling the pH of the plating bath.